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ABSTRACT

The purpose of this study was to investigate three types of academic advisement used in computer based instruction (CBI) with learner controlled conditions and their effects when used among learners of varying locus of control orientation. There were three advisement treatments: (1) adaptive, which gives information related to the amount of instruction the learners need to do; (2) evaluative, which gives information on the required mastery level; and (3) directive, which includes advice on how to go about the instruction or how to approach the lesson. Using Rotter's I-E scores, learners were classified as having internal, middle, or external locus of control. A randomized, posttest-only design was used. Seventy-four preservice teachers worked on a tutorial about Gagne's events of instruction, received advisement during the practice phase of the lesson, and took the posttest. Main effects and interaction were tested using two-way ANOVA. When no interaction was found significant and main effects were significant, mean scores were compared using Fisher's PLSD. Compared to evaluative advisement, adaptive advisement resulted in the following: higher posttest achievement, advisement being followed more frequently during the start of the practice phase; and greater amount of practice done. Among LOC groups, externals followed the advisement given just as frequently as internals. Both groups chose to do the same amount of practice but their achievement differed. Internals did better than externals on the posttest. (16 references) (DB)

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The Effects of Advisement and Locus of Control on Achievement in Learner-Controlled Instruction

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Paper presented at the Annual International Conference of the Association for the Development of Computer-based Instructional Systems (32nd, San Diego, California, October 28-November 1, 1990).

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In computer-based instruction, learner control refers to the presence of instructional design options which give learners the choice to make decisions, to exercise control, and to assume some amount, or even total responsibility regarding their instruction. Learner control has been considered a positive distinction of computer-based instruction because it enables the individualization of instruction through [illegible] of the interactive nature of computers. Learner control is provided in computer-based instruction under the rationale that it is motivating and that learners can tell what is best for them. However, the effectiveness of learner control has not been optimized due to difficulties on the part of learners to make good decisions (Carrier, Davidson, & Williams, 1985; Hannafin, 1984; Snow, 1980; Steinberg, 1977). Therefore, learner control with advisement has been recommended when designing instruction for computers (Carrier, 1984; Johansen & Tennyson, 1983).

Advisement. Various types of advisement have been included in CBI lessons to assist learners in making informed decisions. *Adaptive* advisement gives information related to the amount/sequence of instruction the learners need to do based on their initial or current performance level. This type includes (a) advice on initial learning needs, that is, amount and sequence of instruction needed to achieve objectives (Ross & Rakow, 1981); (b) advice on current learning needs in terms of amount and sequence of instruction needed for the task at hand (Johansen & Tennyson, 1983). Providing adaptive advisement has been, so far, the most common way of making the instructional design adaptive under learner control conditions.

Advisement on current learning level in relation to required mastery level (Goetzfried & Hannafin, 1985; Tennyson, 1980) may be considered as *evaluative* advisement. It gives learners information on how they fare in relation to the mastery level to be achieved, thus giving them a perception of how much more instruction they have to do. The final type of advisement, *directive* advisement, includes advice on how to go about the instruction or how to navigate the lesson. One of the few studies that used directive advisement under learner control conditions was done by Gleason (1986). It resulted in no significant difference on test scores of groups with and without pre-instructional advisement on instructional event selection.

Locus of Control (LOC). A psychological construct which could affect learning under learner control conditions in computer-based instruction is locus of control. It is defined as a general expectation for internal or external control of reinforcements. Locus of control is internal if a learner holds the belief that the outcome of a situation is contingent on his or her behavior. The belief that an event is caused by factors beyond the individual's control (e.g., luck), makes locus of control external (Stipek & Weisz, 1981).

Information assimilation, attention, sensitivity to the meanings or reinforcement opportunities inherent in different tasks and situations, and concentration are some of the cognitive activities in which differences between internals and externals have been identified by Lefcourt (1984). He concluded that internals have been found to be more perceptive to and ready to learn about their surroundings. They are more inquisitive; they are more curious and efficient processors of information than are externals.

A cognitive reaction given by Bar-Tal and Bar-Zohar (1977) which results from one's perception of control is that individuals who feel that they can influence the environment will actually seek ways to control that environment, when that control can be

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instrumental in attaining their goals. They further add that to manipulate the environment, individuals must be able to collect and use relevant information. These statements definitely suggest links between locus of control, learner control, and advisement. Whether or not learners with different locus of control orientations will benefit as much from computer-based instruction that includes learner control and advisement features has yet to be determined.

Study

There is agreement in the literature that advisement could help bring about better learner performance under learner control situations. Various types of advisement have been provided learners to make CBI more effective. However, only a very limited number of studies have been done to examine the effects of various types of advisement under learner control conditions and their findings have been equivocal and inconclusive. Furthermore, the effects of psychological factors, such as locus of control, have likewise not been specifically resolved. The question of which type of advisement should be used for which type of learners when providing learner control in CBI remains a problem for instructional designers.

Purpose. The purpose of this study was to investigate three types of advisement and their effects when used among learners of varying locus of control orientations. Specifically, the study investigated (1) the differences in the achievement of learners when exposed to different forms of advisement and when they are identified to have differing locus of control orientation; (2) the interaction between the types of advisement used in learner control conditions and the learners' locus of control orientation; and, (3) the differences in the decisions learners make regarding their instruction as a result of the type of advisement received and their locus of control orientation.

Design. The independent variables were types of advisement and locus of control. The students' posttest achievement served as the dependent variable. There were three advisement treatments, namely, adaptive, evaluative, and combined (adaptive-evaluative). Using Rotter's I-E Scores, learners were classified as having internal, middle, or external locus of control. A randomized, posttest-only design was used.

It was predicted that the combined form of advisement would produce the best performance results among the three advisement treatments and the students receiving the combined advisement would follow the advisement more often and choose to do more practice than students receiving the adaptive or evaluative forms of advisement. The prediction was based on previous findings of similar studies and by the fact that learners would be given access to more information upon which they could base their decisions. Learners with internal locus of control were likewise predicted to perform better than externals in their posttest performance and in the way they followed and used advisement in the practice phase of the lesson. Internals have been consistently reported in the literature to have better achievement and cognitive abilities as a result of their general expectancy of an internal control of reinforcements

Seventy-four pre-service teachers at the University of Georgia's College of Education who volunteered to participate in the study were randomly assigned to one of the three treatments after measuring their prior knowledge of the lesson content with a pretest instrument and their locus of control orientation using Rotter's I-E Scale (1966). The students then worked on a computer-based instruction module dealing with Gagne's (1988) nine events of instruction and received advisement in the practice phase of the lesson. The advise given them depended on the treatment group to which they were randomly assigned. A posttest was given afterward to measure the learners' achievement.

Results

Rotter's I-E Scores. The frequency distribution of I-E scores which resulted from this set of participants was bimodal. Consequently, a three-way grouping was established by identifying students with scores of 0 to 9 (40%) as internal, 10 to 12 as middle (22%), and 13 to 23 as external (38%). Each group had N=30, N=16, and N=28, respectively. Advisement grouping resulted in N=25, N=26, and N=23 for the adaptive, evaluative, and combined groups, respectively.

Pretest Scores. To be considered knowledgeable of the content prior to instruction, a learner must attain a score of at least 10 out of the 13-item pretest, or a mastery level of 80% or higher. The range of scores that was obtained by the participants was 0 to 5, indicating that none of the students possessed mastery of the lesson content. The group mean was 1.3 with a standard deviation of 1.1.

Posttest Scores. As a group, the 74 students had a mean score of 16.4 and a standard deviation of 4.9. The highest score was 25 and the lowest was 5. Only 20% of the students (15 out of 74) achieved a mastery level of 80% or higher. Mean scores for the rows (LOC), columns (advisement), and individual cells are given in Table 1.

Group		Adaptive	Evaluative	Combined	Totals
Locus	Internal	19.6 (3.60) N=10	16.3 (5.03) N=12	18.0 (3.55) N=8	17.8 (4.33) N=30
	Middle	21.6 (3.13) N=5	12.5 (1.29) N=4	15.3 (4.50) N=7	16.6 (4.97) N=16
	External	14.7 (5.64) N=10	15.1 (4.20) N=10	14.3 (6.27) N=8	14.7 (5.18) N=28
Totals		18.0 (5.17) N=25	15.2 (4.40) N=26	15.9 (4.98) N=23	16.4 (4.94) N=74

Note: Numbers in parentheses indicate standard deviation.

Table 1. Summary Table Showing Mean Scores, Standard Deviations and Number of Subjects

Achievement of Advisement Groups. When analysis of variance was used to test for main effects of the first independent variable, advisement, a significant difference was found to exist ($F = 4.4$, $p = .0161$, see Table 2). This indicates that there is a difference in the performance of students who were given various forms of advisement.

Source	df	Sum of Squares	Mean Square	F-test	P-value
Advisement	2	185.324	92.662	4.4	.0161
Locus	2	151.767	75.884	3.604	.0328
Interaction	4	152.489	38.122	1.81	.1375
Error	65	1368.779	21.058		

Table 2. ANOVA Table for Advisement and LOC Effects and Their Interaction Using Posttest Scores

Although on the average, 23.7% of internals and 21.6% of externals followed advisement, these data were not considered sufficient to constitute any substantial finding.

Amount of Practice Done. The computer-based instruction was designed such that the minimum number of questions a student could choose to do was 3 and the maximum was 18 questions.

Advisement Groups. Results show that students in each advisement group did an average of 9 questions while those in the evaluative and combined groups did an average of 6 and 7 questions, respectively. The adaptive group chose to do more questions per round than either the other two groups ($F = 6.064$, $p = .004$). None of the students in the adaptive group did just the minimum number of practice questions, which is 3. The minimum choice was 4 practice questions. The maximum choice was the same as the maximum number of practice questions available, which is 18. Students in the evaluative and combined groups had a minimum choice of 3 and nobody did more than 13 practice questions.

LOC Groups. The same analysis of the amount of practice done with the advisement groups was applied to students having internal and external locus of control orientations. Results indicate that internals and externals did not differ in the amount of practice questions they chose to do. In other words, internals and externals, on the average, chose to do 7 questions per practice round in this lesson. As for the maximum number of questions done, externals did as many as 18 practice questions whereas internals did no more than 13 questions.

Discussion

Achievement of Advisement Groups. Significant statistical differences were found in the posttest performance of learners as a result of being exposed to three different types of advisement. Students in the adaptive group received information which was appropriate and adapted to their needs. Based on their responses in the checklist, most of these students (96%), after having read the advisement, found it easy to make a decision as to how much practice they would do. Then, advisement was followed, on the average, by 52% of the students. The result was a mean score of 18.0, the highest mean score among the three groups.

Students in the evaluative group, on the other hand, received information that indicated their current state of knowledge and matched it against the program criterion. This information did not seem sufficient for these learners to follow the advisement nor make the appropriate choice as to the amount of practice that needed to be done. Their mean posttest score was 15.2. Having a pretest score well below the required mastery level of 80%, each student should have chosen to do all three practice questions in every practice set. However, on the average, only 13% of the group selected to do all three practice questions while two-thirds (63%) of the students chose to do only one practice question. The tendency shown in this study was for the evaluative group to choose less practice than the adaptive group.

The voluntary nature of student participation in the study could explain why, overall, only 20% of the students achieved a mastery level of 80% or above in the posttest. It could have also affected the lower achievement of students in the evaluative group. To these students, receiving an evaluation of their practice performance was not related to how they will be evaluated in the course. Thus, this kind of information could have been considered by these students to have much less meaning than adaptive information was to the students in the adaptive group.

The evaluative group had the highest percentage of students (22%) who responded in the checklist that making decisions on one's own was difficult. This indicates that providing information on one's current state of knowledge may improve learners' perception of how far they are from achieving mastery but this still does not make the task

of making decisions on the appropriate amount of instruction easier for learners.

These findings seem to indicate that providing specific information adapted to learners' needs results in better performance than information on learners' current states of knowledge. Even when information on learners' current states of knowledge is provided, learners may still find it difficult to make decisions about their instruction and have a tendency to choose to do less than is needed to achieve lesson outcomes.

There was no significant difference found between the posttest results of students in the adaptive and combined groups, and in the adaptive and evaluative groups. These results indicate that one advantage of using either adaptive or evaluative advisement over combined advisement would be in terms of efficiency. Increasing the amount of information given, as in the combined group, does not necessarily increase the performance of students. If only one type of advisement is provided the learners, it is adaptive advisement that produces the best results.

Achievement of LOC Groups. The statistically significant differences in the performance of students with internal, middle, and external locus of control (LOC) indicate that in computer-based instruction with learner control conditions, the performance of learners with differing locus of control orientations will also differ. When comparisons were made between LOC groups, internals were found to significantly outperform the externals on posttest achievement.

Internals have been reported in the literature to use and assimilate information in better ways and to have better academic achievement than externals. The results of this study support those findings. The explanation offered by Lefcourt (1982) was that internals take responsibility for their decisions and behavior, thus engage in better ways of processing information, which in turn, results in better performance. Regardless of what information is given them, they can identify which information will help them reach their goals or purpose. Reviews of studies by Bar-tal and Bar-zohar (1977) and Stipek and Weisz (1981) lend further support to the positive relationship between achievement and locus of control. Motivational factors that could have caused differences in the way internals and externals made decisions in this learning situation were reflected in the checklist responses. The learning experience was rated by 74% of the internals to be enjoyable as compared to 46% by externals. Only 23% of internals found the content to be difficult while more externals thought it was difficult (31%). Overall, the lesson was rated to be easy by 64% of the internals and 43% by externals.

The middle LOC group was not found to be statistically different from the internal nor the external groups. The frequency distribution of the I-E scores was bimodal and there is a strong possibility that the middle group was composed of people who could either be internal or external. Thus their performance did not differ significantly from the other two LOC groups.

Interaction. No interaction was found between the form of advisement given to learners and their locus of control orientation. This implies that internals, in general, would have higher posttest achievement than externals regardless of the form of advisement given them. Externals, on the other hand, consistently got lower posttest scores in most of the treatments. Similarly, adaptive advisement produced higher achievement than evaluative advisement, indicating that the effectiveness of adaptive advisement did not depend on the learners' locus of control orientation.

Frequency Advisement Was Followed by Advisement Groups. The fact that this instructional experience is new to students and the way advisement was presented on screen could have contributed to the differences in students' decisions to follow or reject advisement as they moved from one practice set to the next. The adaptive advisement was presented in a shorter paragraph and was easily identifiable on screen. For combined advisement, the students had to read more text and the recommended number of practice

questions was presented towards the middle of a longer paragraph of advisement. The effects of presenting advisement in longer texts versus shorter ones is a factor that could have influenced the way advisement was attended to and followed in the first practice set. However, as students moved on to the next two practice sets, the difference in the percentages of those who followed advisement in each group decreased and became statistically non-significant, possibly, as a result of having familiarized themselves with the advisement procedure and the screen design. Peters (1988) reported a similar case in his study where students did not seem to fully grasp the use of advisement when used the first time and they made good use of it only later in the study after some explanations were done.

Frequency Advisement Was Followed by LOC Groups. In the case of internals and externals, the difference in the frequency they followed the advisement given was not statistically significant. A trend, however, was noted. During the initial part of the practice phase, it was the internals who followed advisement more often than externals. A possible explanation for this is that internals decided to play it safe by following the advisement the first time it was encountered and then went to decide on their own in the succeeding practice sets. Externals, on the other hand, were seen to be taking a chance by going on their own and not following the advice initially but by the second half of the practice phase, more externals eventually chose to accept the advisement suggested. Internals have been reported by Rotter (1966) to be resistive of subtle attempts to be influenced, a result of taking responsibility for their own actions. He further explains that internals have been found to change in their attentiveness and concern with the type of task they are engaging in. If the task seemed important or challenging, then they became more deliberate in their decision making. Externals were reported not to have such ability except when the task was chance-determined. These statements could help explain this trend.

Amount of Practice Done by Advisement Groups. Students in the adaptive advisement group did more practice questions than students in the evaluative advisement group. This difference appears to be a consequence of an earlier decision to follow the advisement given where, for every piece of advice followed, the student was doing the maximum number of three questions. Even with the inclusion of the evaluative group in the analysis, this finding was not altered. The adaptive group was still found to have done more practice when compared to the evaluative group. It will be recalled that students in the evaluative group made their own decisions regarding the particular number of practice questions they wanted to do after being informed of their current learning level. Most of them decided to do only one practice question.

The advantage of having followed advisement was carried over to having done more practice which, in turn, was found to correlate positively with posttest performance.

Amount of Practice Done by LOC Groups. Internals and externals were found to have done an average of 7 practice questions each. The prediction was for internals to be doing more practice because of their reported tendency to engage more in information-seeking. While this statement was confirmed by Lefcourt (1982), he also added that the better assimilation and use of information by internals is related to their ability to recognize the pertinence of information for their purposes; internals are known to be more certain of their values and purposes. Thus, in selecting the amount of practice for this study, internals could have chosen an amount suitable for their purposes and this was proven by their higher performance in the posttest. This amount did not seem to be more than what was necessary and was equal to the number of practice problems externals chose to do.

Conclusions

Based on the results of the study, the following conclusions are given and need to be interpreted based on the limitations that this study involved voluntary participation by

students who were all found to be below the required mastery level in their prior knowledge of the lesson content and that the study was conducted within a limited length of time and with a small group size.

1. Adaptive advisement resulted in higher posttest performance than evaluative advisement when used in computer-based instruction with learner control conditions.
2. Students identified with internal locus of control orientation had higher posttest achievement than students with external locus of control orientation.
3. The effectiveness of adaptive advisement does not depend on the learners' locus of control orientation.
4. Internals had higher posttest achievement than externals regardless of the form of advisement given them in a CBI lesson with learner control.
5. Students receiving adaptive advisement followed advisement more frequently than students receiving combined advisement during the start of the practice phase but the difference became statistically non-significant as they did the rest of the practice sets.
6. Students receiving adaptive advisement chose to do more practice problems than those in the combined and evaluative advisement groups.
7. Students with external locus of control orientation followed advisement just as frequently as students with internal locus of control orientation and both LOC groups chose to do a similar amount of practice but their performance in the posttest differed. Internals were able to choose the amount of information suitable for their purposes and had higher posttest achievement than externals.

Implications for CBI

Adaptive advisement in this study proved beneficial to students in three aspects: effectiveness, appeal, and efficiency. Its effectiveness came in the form of mean scores which were higher than those gained by students exposed to two other advisement treatments. Its appeal was in the ease by which learners could make decisions on their own after receiving the adaptive information. With adaptive advisement, higher achievement resulted without having to provide as much information as the combined form of advisement. This makes it more efficient in terms of instructional design and software development. The use of adaptive advisement is an immediate application an instructional designer could consider in improving techniques for CBI that has learner control features.

It is the utilization of CBI information more than the utilization of CBI options and decision-making by internals and externals that could be considered as the more immediate concern of designers of CBI when dealing with locus of control orientation of learners. That internals could perform better than externals in spite of the lack of significant differences in their decision-making lends further support to previous reports that internals do process information better than externals. Instructional designers should look further into the role that CBI could play in effecting any possible shift from an external locus of control to an internal one.

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(Abstract)

The purpose of this study was to investigate three types of advisement used in CBI with learner control conditions and their effects when used among learners of varying locus of control (LOC) orientation. There were three advisement treatments: adaptive, evaluative, and combined. Using Rotter's I-E scores, learners were classified as having internal, middle, or external LOC. A randomized, posttest-only design was used. Seventy-four pre-service teachers worked on a tutorial about Gagné's events of instruction, received advisement during the practice phase of the lesson, and took the posttest.

Main effects and interaction were tested using two-way ANOVA. When no interaction was found significant and main effects were significant, mean scores were compared using Fisher's PLSD. Compared to evaluative advisement, adaptive advisement resulted in the following: higher posttest achievement; advisement being followed more frequently during the start of the practice phase; and, greater amount of practice done. Among LOC groups, externals followed the advisement given just as frequently as internals. Both groups chose to do the same amount of practice but their achievement differed. Internals did better than externals on the posttest.